Space Weather Forecast

Issued on Monday, 07 February 2022 at 00:53 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Possible Coronal Mass Ejection (CME) en route to Earth. Minor geomagnetic storm G1 likely midweek, perhaps continuing Thursday.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was low through the UTC day of Sunday 06 February, with occasional small Common-class X-ray flares observed. The largest of these events was a long-lasting middling common class X-ray flare, peaking at 06/1341UTC. As is often the case with long-duration flares, this was associated with a possible Coronal Mass Ejection (CME), this example from a 'filament eruption' (arc of plasma leaving the sun) emanating from near the middle of the facing side. Given its emission location and the nature of its departure from the sun, this feature has been modelled by MOSWOC as three separate CMEs to provide a best match to available imagery - with two of these fronts mainly angled below the plane of the Earth's orbit, but the third (the innermost and slowest) bearing a likely Earth-bound component.

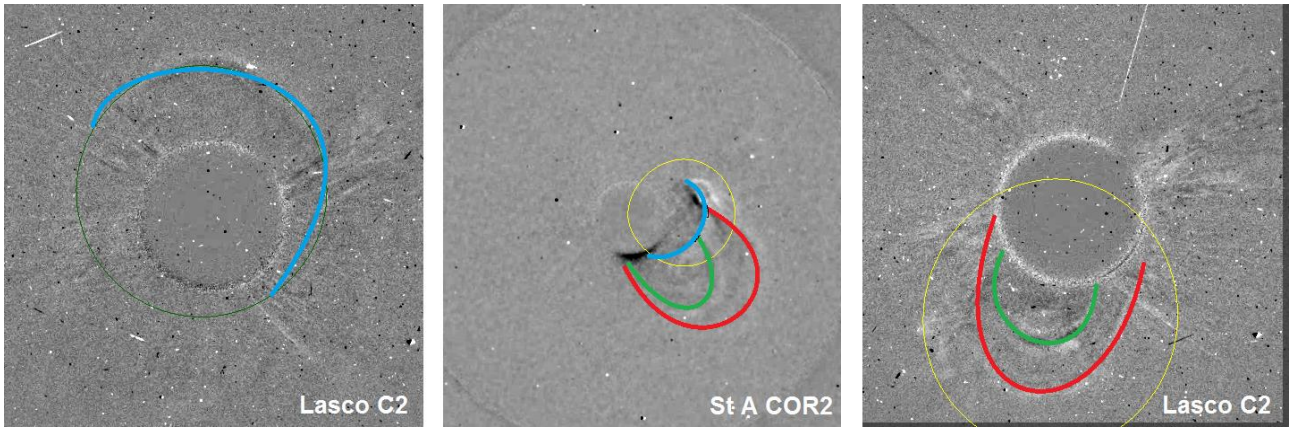

Figure 1: 06 February satellite imagery of the middle-of-the-sun filament eruption, outlining the three main fronts visible from various perspectives. The satellite 'Lasco's' viewpoint being similar to Earth, and 'St A' being in a position around 30 degrees further east along the track of Earth's orbit around the sun. The slowest but potentially most significant part of the CME modelled (for being potentially the most directly-Earthbound) is shown in blue.

In terms of remaining activity, there are currently five sunspot regions on the sun, although these all showed only minor changes in the 24 hours. The two most noteworthy groups in terms of magnetic complexity were both quiet in terms of X-rays, with the 'filament eruption' emanating from the vicinity of a third sunspot group that was otherwise largely docile.

Solar Wind / Geomagnetic Activity: The solar wind was characteristic of ongoing connection to a fast wind 'high speed stream', probably that from a now no longer distinguishable (from an Earth viewpoint) 'coronal hole' near the southwestern horizon of the sun. This feature may have cleanly

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segued into a second hole, with effects from these likely proving indistinguishable from each other.

The solar wind speed was elevated in the 24 hours, but with a gradual downward trend becoming apparent. The number of particles comprising the solar wind and their associated magnetic field were both stable and unremarkable in the period.

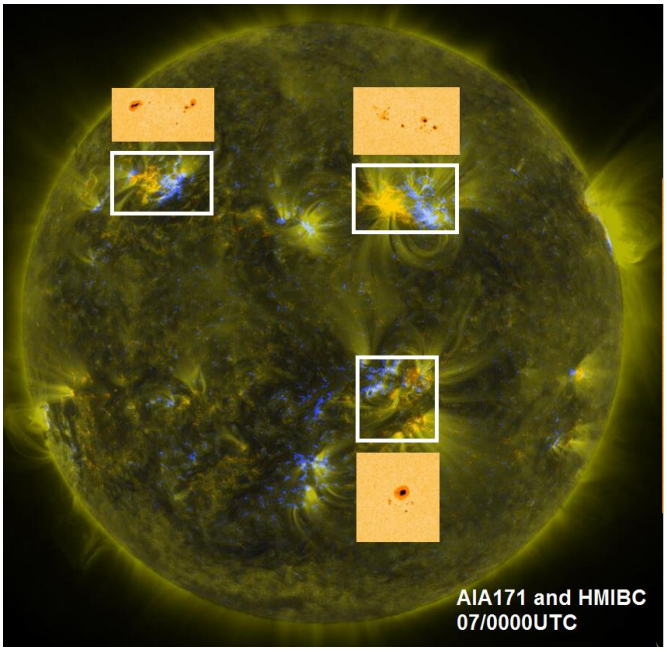
The net effect of the above solar wind measures was a little restive, peaking just below Minor Storm G1 early in the 24 hours, but with an overall slight decline then observed.

Energetic Particles / Solar Radiation: No solar radiation storms have been observed.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be low in the period. No significant sunspot regions appear to lie over the eastern solar horizon, while up to two current front-sided regions may cross onto the far side into the new working week. This leaves the three most potent groups present throughout the four days on the Earth-facing side, giving only a very modest decline in X-ray flare risk - with common-class flares expected daily and moderate-class perhaps a daily 30% chance, falling slightly to 25% with time.

Figure 2: Configuration of the three largest sunspot groups on the current Earth-facing side of the sun. The 'filament eruption' discussed in this document came from near the southernmost at 06/1341UTC.



Solar Wind / Geomagnetic Activity: The current fast solar wind regime is likely to be the peak persistent feature in the four-day period, now expected to gradually wane through to midweek UTC.

There is then the consideration of the possible arrival of the 06 February filament eruption CME. This has been modelled and offers a likely Minor geomagnetic storm G1 on day three, Wednesday 09 February, perhaps continuing as a chance of similar into day four. There is an accompanying slight chance of Moderate storm G2, with this not the favoured scenario but most probable near onset should it occur.

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Energetic Particles / Solar Radiation: Solar radiation storms carry a daily slight chance of rising close to or just above the S1 level given any significant moderate-class X-ray flaring, although this has not yet been borne out.

Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	60	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	30	30	25	25
Very Active	R3 to R5 X	No	2	2	2	2

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	2	2	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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